

# The frequency rate of cardioembolic etiology in North American and Iranian stroke patients: A pilot double-center study

K Ghandehari<sup>1\*</sup>, A Shuaib<sup>2</sup>, G FatahZadeh Ardalani<sup>3</sup>

<sup>1</sup>Department of Neurology, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran, <sup>2</sup>Department of Neurology, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Canada, <sup>3</sup>Resident, Department of Neurology, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

## Abstract

**Background:** Cardioembolism is among the most important causes of ischemic stroke around the world. A pilot double-center study evaluated the subtypes of cardioembolic mechanisms in stroke patients in two different racial subtypes.

**Methods:** This prospective clinical study was conducted on 100 stroke patients in Mackenzie Hospital in Canada and 100 stroke patients who were age and sex matched in Ghaem Hospital in Mashhad, Iran in 2007. All of the Canadian patients were of white North American race and all of the Iranian ones of white Persian race. The diagnosis of ischemic stroke was made by stroke neurologists.

Assessment of the cardioembolic mechanisms was made based on the standard method. The frequency of ischemic heart disease, congestive heart failure and atrial fibrillation was detected in the two studied groups.

**Results:** 92 males and 108 females with ischemic stroke were studied. The influence of race on the frequency rate of ischemic heart disease, congestive heart failure and atrial fibrillation was not significant. However, rheumatic mitral valve disease was significantly more frequent among the Iranian group. The effect of race on the frequency rate of other cardioembolic mechanisms was not significant in each gender separately. However, atrial fibrillation was significantly more frequent in Canadian females.

**Conclusions:** There was no significant difference in the frequency rate of cardioembolic mechanisms between North American and Persian stroke patients except for rheumatic mitral valve disease.

**Keywords:** Cardioembolism; Stroke; Race; Canada; Iran

## Introduction

The prevalence of stroke and its risk factors varies by race-ethnicity.<sup>1</sup> It has been shown that modification of several major risk factors of stroke can reduce the incidence of stroke. These differences are crucial to the etiology of stroke and the design of stroke prevention programs.<sup>1</sup> While a quarter of strokes are cardioembolic,

the cardiac source of embolism is considered as a modifiable risk factor of stroke. The distribution of cardiac pathology as the cause of embolic stroke varies in different countries.<sup>2</sup> Cardioembolic strokes represented 14% of the Stroke Data Bank,<sup>3</sup> 20% of the Lausanne Stroke Registry,<sup>4</sup> and 25.6% of the German Stroke Data Bank.<sup>5</sup> This pilot double-center study was designed for evaluation of cardioembolic mechanisms in patients with ischemic stroke.

\*Correspondence: Kavian Ghandehari, MD, Associate Professor of Department of Neurology, Ghaem Hospital, Ahmadabad Street, Mashhad University of Medical Sciences, P.O.Box:91766-99199, Mashhad, Iran. Tel: +98-511-8012398, Fax: +98-511-8429828, Mobile:+98-915-1076145, e-mail: [kavianghandehari@yahoo.com](mailto:kavianghandehari@yahoo.com)  
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## Materials and Methods

100 consecutive ischemic stroke patients admitted in

Walter Mackenzie Hospital in Canada and 100 consecutive ischemic stroke patients admitted in Ghaem Hospital in Iran were enrolled in this cross-sectional prospective study. The Canadian patients were of white North American race and the Iranian patients were of white Persian race. Ischemic stroke patients were age and sex matched in the two groups. The diagnosis of ischemic stroke was made by stroke neurologists. Stroke was defined as an ischemic focal neurological deficit that persisted at least 24 hours.<sup>6</sup> All of the ischemic stroke patients had one or more control brain Computerized Tomography (CT) 48-hour post-stroke.<sup>6</sup> All of the ischemic stroke patients underwent a standard battery of etiologic investigations including ECG, blood electrolytes, blood count and differential coagulation profile, fasting blood sugar and lipid profile, duplex sonography of supra-aortic trunks and transcranial doppler.<sup>6</sup> The cardioembolic assessment included Electrocardiography (ECG), serum troponin, and transthoracic echocardiography.<sup>7</sup> A 24 hour, Holter monitoring was obtained in patients with a history of syncope and/or palpitation with non-diagnostic ECG.<sup>7</sup> Transesophageal echocardiography was performed in those for whom transthoracic echocardiography was non-diagnostic despite high suspicion of cardioembolism.<sup>7</sup> Three serial blood cultures were requested for any stroke patient with fever and heart murmur or valvular vegetation detected by echocardiography.<sup>7</sup> Performing TEE, Holter monitoring and blood culture are not indicated in all stroke patients.<sup>6,7</sup> There are ethics limitations to do expensive and semi-invasive TEE in the stroke patients only for research purposes. These differential levels of assessment are a standard protocol in the diagnostic workup of cardioembolic mechanism in stroke patients and do not influence the diagnoses.<sup>6,7</sup> Holter monitoring and transesophageal echocardiography and blood culture were requested in 20%, 14% and 8% of the patients, respectively.

Cardioembolic mechanisms were detected by cardiologists based on the clinical manifestations and diagnostic investigations. They were categorized as Ischemic Heart Disease (IHD), Congestive Heart Failure (CHF), Atrial Fibrillation (AF), and Rheumatic Mitral Valve Disease (RMVD). The effects of race and gender on the frequency of cardiac sources of embolism were analysed by Fisher Exact test and a  $p < 0.05$  was considered significant. The protocol was approved by our Institutional Ethics Committee and an informed consent was obtained from each subject and/or their guardians.

## Results

200 ischemic stroke patients (92 males, 108 females) were evaluated. The mean age of the North American and Iranian stroke patients was 71.9 (SD=11.0) and 68.7 (SD=5.3) years, respectively. In the Iranian group, IHD was found in 23% of the cases followed by AF (11%), RMVD (10%) and CHF (9%). In North American group, IHD was detected in 33% of the cases followed by AF (18%), CHF (7%) and RMVD (2%). The effect of race on the frequency of IHD, AF and CHF in all of the stroke patients was not significant ( $df=1$ ,  $p=0.115$ ), ( $df=1$ ,  $p=0.159$ ) and ( $df=1$ ,  $p=0.603$ ), respectively. RMVD was significantly more frequent in the Iranian group ( $DF=1$ ,  $p=0.017$ ). Table 1 displays the effect of race on the frequency of cardioembolic mechanisms in each gender separately. Carotid stenosis more than 50% was found in 27 % of North American and 23 % of Iranian stroke patients which was not significantly different ( $df=1$ ,  $p=0.305$ ).

## Discussion

Comparisons of variability in the occurrence of stroke

**Table 1:** Effect of race on the frequency rate of cardioembolic etiologies in each gender separately. Data are presented in percentage.

Cardioembolic mechanisms	NA females %	Iranian females %	NA males %	Iranian males %	Race difference in females	Race difference in males (df, pv)
Ischemic Heart Disease	31.5	24.1	34.8	21.8	Df=1 p=0.389	1, 0.165
Atrial Fibrillation	25.9	11.1	8.7	2.2	Df=1 p=0.047	1, 0.5
Congestive Heart Failer	9.3	5.5	4.3	13	Df=1, p=0.358	1, 0.133
RMVD	3.7	11.1	0.0	8.7	Df=1 p=0.135	1, 0.058

NA: North American RMVD: Rheumatic Mitral Valve Disease

mechanism in different races are often confounded by factors other than racial differences.<sup>1</sup> These include socioeconomic, lifestyle and nutritional factors as well as a variation in the frequency of risk factors in different racial groups.<sup>1</sup> In recent years, attempts have been made to determine differences in frequency of stroke risk factors and etiologies in different racial groups in a single geographic location.<sup>1,2</sup> Such research indicates the contribution of these risk factor differences to variations in the frequency of stroke.<sup>1,2</sup> This research is designed to compare these differences in two Caucasian white races living in two distant continents. In our study groups, the effect of race subtypes and geographic differences on the frequency of cardioembolic mechanisms was only significant for RMVD in all of the stroke patients. It was found to be more frequent in Iranian stroke patients. Rheumatic heart disease is an important cause of mitral and aortic valve disease in developing countries.<sup>8,9</sup> Almost half of the cardioembolic strokes in developed countries are secondary to non-valvular AF and 7.6% of cardioembolic mechanisms are due to rheumatic heart disease.<sup>10</sup> In the Khorasan Stroke Registry

Data Bank, rheumatic valvular disease comprised 44.8 % of the cardioembolic mechanisms and caused 4.3 preventable stroke cases per 100000 Iranians per year.<sup>6,7</sup> RMVD was present in 63 % of Iranian stroke patients with atrial fibrillations.<sup>6,7</sup> It has been reported as a common cause of stroke in Iran.<sup>11,12</sup> Cardiac disease was found in 23% of Ethiopian stroke patients, and valvular heart disease comprised 40% of all heart diseases in these stroke patients.<sup>13</sup> Distribution of IHD, AF and CHF was not significantly different between North American and Iranian stroke patients in our pilot double-center study. In an American epidemiologic study, Hispanics and Blacks were less likely than whites to report IHD.<sup>14</sup> The Northern Manhattan Stroke Study revealed that AF, IHD and CHF were less prevalent in American Blacks and Hispanics.<sup>15</sup> A European epidemiological study revealed that AF was significantly more frequent in female stroke patients.<sup>16</sup> The frequency of AF was significantly higher in our North American female stroke patients. The cause of this gender discrepancy is unknown. Gender preponderance to the other cardioembolic mechanisms was not found in our double-center study.

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